

## PROCEEDINGS OF OBSERVATORIES.

The following Reports of the proceedings of Observatories during the past year have been received by the Council.

*Royal Observatory, Greenwich.*

In addition to the usual observations with the Transit-circle and Altazimuth, a series of micrometric measures of *Saturn's* satellites has been made with the Great Equatoreal, Mr. Marth's ephemeris having been found of great use in the identification of these objects. The measures were much interrupted by bad weather, but fairly complete sets have been obtained on nineteen days, and the observations are ready for communication to the Society. The results of the series of differences of R.A. and N.P.D. of cusps made during the Solar Eclipse of last September have been already published in the *Monthly Notices*.

The Great Equatoreal has also been used (in addition to the Sheepshanks Equatoreal and Altazimuth) for occultations of stars by the Moon, and for phenomena of *Jupiter's* satellites; but the chief work to which this instrument has been devoted has been the spectroscopic examination of the Sun and of stars. The results of the latter are given in the *Monthly Notices* for November, and the agreement with Dr. Huggins' observations is most satisfactory, when the measures which are known to have been made under bad circumstances are rejected. With a single exception, the two sets of observations agree as to the direction of motion of all the stars (12 in number) common to both, and for those that have been well observed in both series the numerical values differ generally by less than 10 miles a second, which is quite as close an agreement as could be expected from the nature of the case. The star  $\eta$  *Ursæ Majoris* offers the only instance of discordance, and it is to be remarked that Dr. Huggins does not express himself with any confidence as to his observation of this star. The Solar prominences have been mapped on 31 days with the Observatory Spectroscope, and the breadths of the Fraunhofer lines have been measured with the powerful Spectroscope which Mr. Spottiswoode kindly lent to the Observatory. All these observations have been much interrupted by the exceptionally bad weather of the past year; and also to a less degree by the alterations which were found necessary in the Observatory Spectroscope. As bearing on the constitution of comets, a careful comparison has been made of the spectra of the various carbon compounds, the two spectra to be compared being placed side by side in the same field, and the relative position, brightness, and degree of shading off of the bands noted. It is proposed to repeat these observations with carefully prepared vacuum tubes.

With the Photo-heliograph 346 photographs have been selected from those taken on 166 days in 1875; an unusually small number, though every opportunity, on Sundays as well as week days, was taken advantage of. Since last September the Photo-heliograph returned from the Transit of *Venus* Expedition to New Zealand has been used for this work. Many of the photographs are entirely without spots, and a similar absence of prominences has been remarked with the Spectroscope. The areas of the spots and faculae have been measured and completely reduced to the end of 1874, and the results are in the printer's hands for insertion in the forthcoming volume for 1874.

The weather was generally unfavourable for the observation of the August and November meteors: the night of November 14 was, however, fine, and a strict watch was maintained throughout; but owing to the brightness of the Moon, only large meteors could be seen. One meteor was recorded on November 13, and 25 on November 14. Some of those observed on the latter night did not belong to the stream of the *Leonids*.

From a change made in the position of the division used for the Nadir observation in the field of view of the Transit-circle Microscopes, it appeared that the correction to the Nadir observation depended on the part of the micrometer screws used, its value having changed from  $-0''\cdot 7$  to  $+0''\cdot 6$ . This led to the supposition that the screws had worn considerably, an inference which was confirmed by a determination of the values of successive revolutions (by means of the South Collimator) as well as by Nadir observations taken with the same division in different parts of the field; at the same time the telescope-micrometer screw was found to be free from sensible error. To test this important point still further, the four supplementary microscopes used for examining the division-errors were mounted, and the results given by them compared with those given by the six ordinary microscopes for every observation during a period of two months. A table of corrections to circle readings for every revolution and tenth of the six ordinary micrometers has in this way been formed, and these, which range from  $-1''\cdot 07$  to  $+0''\cdot 75$ , are being applied to all observations of stars since the completion of the second Seven-year Catalogue in 1867. The investigations of R—D correction and of co-latitude will be slightly affected, but the determinations of flexure will be free from sensible error. The old screws have now been replaced by new ones, made with very great care, which are now being compared with those of the supplementary microscopes. The adoption of a correction to the Nadir observations for some years past makes the adopted Zenith-points free from systematic error, as the observations of stars by reflection are on the whole distributed equally over the range of the micrometer screws.

Among the instrumental changes may be mentioned the alteration of the Altazimuth Collimator, which is now horizontal, and therefore gives the collimation error independently of the observation of a high star.

Various alterations have been made in the Spectroscope, chiefly with a view of improving the definition; but though a viewing telescope with right-angled reflecting prism was mounted as in the ordinary form of solar spectroscope, matters appeared to be worse instead of better, and it was ultimately found that all the trouble arose from the deviation through the first half prism (compound) being  $5^{\circ}$  greater than it should have been; in consequence of which the pencil did not fall fairly on the train of prisms, and there was a great deal of false light reflected from the base of the prisms. It can only be conjectured that some mistake had been made in the density of the flint glass, and Mr. Hilger is now correcting this by increasing the angle of the crown prism. From trials that have been made, there is no doubt that the definition will be very fine when this defect is corrected. For more accurate measure of lines in stellar spectra, Mr. Hilger has applied a new form of bright-line micrometer which has given excellent results, and other small additions (mentioned in the *Monthly Notices* for last November) have been made as suggested by experience. It is in contemplation to commence a series of measures of the breadth of the lines of hydrogen and other elements at different pressures, and with this object in view a Sprengel pump on Mr. Crookes' model has been supplied by Mr. Hicks.

Preparations have been made for a Nine-year Catalogue of all stars observed from 1868 to 1876, the special feature of which will be the circumpolar stars, which have been observed assiduously since 1872. It is hoped that there will be very few stars in this catalogue which have not been observed at least three times both in R.A. and N.P.D.

The reductions are in a very forward state, and the printing of the volume for 1874 is well advanced; that for 1873 has been distributed.

The Transit of *Venus* reductions are proceeding vigorously under Capt. Tupman's immediate superintendence, and great progress has been made by Mr. Burton in the measurement of the photographs. A more detailed account is given under the head of "Reduction of the Observations of the Transit of *Venus*."

#### *Radcliffe Observatory, Oxford.*

No important change having taken place since the last Report in the organisation or the subjects of observation of this Observatory, no details will be necessary.

Referring to the Report of the Radcliffe Observer to the Board of Trustees, delivered on the 29th of June 1875, we find that the volume of *Observations* for 1872 was completed and circulated at the beginning of February 1875, and that the volume contained a catalogue of 1,323 stars, 89 observations of

the Sun, 48 of the Moon, 13 of *Mercury*, and 16 of *Venus*; a catalogue of 20 double stars; 12 observations of occultations of stars by the Moon, thoroughly reduced; and, finally, a considerable list of shooting-stars.

At the present time the succeeding volume for 1873 is quite finished and ready for distribution. This volume contains a catalogue of 1,496 stars, 95 observations of the Sun, 55 of the Moon, 20 of *Mercury*, 33 of *Venus*, 24 of *Mars*, and 18 of *Saturn*; a catalogue of 17 double stars, many of them repeatedly observed; 11 occultations of stars by the Moon; a large number of observed phenomena of *Jupiter's* satellites; and, finally, a considerable list of observations of meteors and shooting-stars. The meteorological portion of the volume contains the usual amount of information in the usual shape.

The continued activity of the Observatory is shown not only by the early publication of the volume for 1873, but by the great progress which has been made with the reductions during the past year. Those of 1874 of every sort are complete, and two half-sheets of the transits are printed. The separate results both in R.A. and N.P.D. have been written out, and the Catalogue has been formed and the results entered into it as far as is practicable.

For the year 1875 the reductions of the Right Ascensions and North Polar Distances are nearly complete, and the occultations and other observations of a miscellaneous character have been reduced.

There are still some arrears of the meteorological reductions beyond what is desirable, but it will be now possible to devote a good deal of time to them, and it is hoped that we shall shortly have to report that the reductions have in every department kept pace with the observations.

#### *Oxford University Observatory.*

This Observatory was so fully described in a communication inserted in the *Monthly Notices* of November last, that no further remarks on the subject are required.

On the 2nd of December last the Board of Visitors met at the Observatory for the first time, when the Vice-Chancellor, the Astronomer Royal, and other members of the Board were present. The scheme of observations connected with astronomical physics, proposed by Professor Pritchard, was laid before the Board and approved of.

It is proposed to include in the routine of the Observatory work:—1. The observation of any new comets which may appear; the calculation of their orbits, and the record of their spectra and of other physical circumstances, including the radiants of their possible star showers. 2. The re-observation of such

binary stars as afford the promise of calculable orbits; their orbits, their spectra, and other physical circumstances will be obtained and recorded. 3. A series of lunar photographs is to be taken with the De La Rue Reflector, with the view of ascertaining the existence of any possible physical libration. 4. It is proposed to give immediate attention to any celestial phenomena of especial interest which may occur and fall within the optical means of the Observatory.

The lunar photographs have already commenced. Up to the present time observations of six of the satellites of *Saturn* have been obtained, more or less successfully, during thirty-one nights. The faint satellite *Mimas* was seen on one occasion, and its place estimated. The re-observation of about thirty of the stars in Sir John Herschel's *Catalogue of Double Stars* has been completed, some doubts having been thrown upon their accuracy or identity as they appear in Sir John's compilation. The results will shortly be communicated to the Society, as will also the observations of the satellites of *Saturn*.

### *Cambridge Observatory.*

In a year unusually unfavourable for observation, and with an unavoidable interruption to the work in May and June, we have been able to register 3,302 observations of small stars, and 511 of fundamental stars, with all the requisite observations for level, collimation, and Nadir-point.

All these have been entered in the Reduction Books and the means taken. The Right Ascension observations of fundamental stars are completely reduced up to the end of 1874. The observations for level, collimation, and Nadir-point are reduced up to November 24, 1875. The constants for obtaining the apparent Right Ascensions and North Polar Distances of the Zone stars are completely calculated to the end of 1874, and partially to the end of 1875. In the course of these reductions it has been found that there is still a slight discrepancy in the Nadir-point. When this is found by turning the instrument through the South horizon it is about  $0.^{\circ}16$  greater than when the instrument has been turned through the North horizon.

The Right Ascensions and North Polar Distances for 1867 are printed, and the *Catalogue of Mean Right Ascensions of the Fundamental Stars* for the same year is in the press.

The Meteorological Observations are daily communicated to the Central Meteorological Office in London.

*The Observatory, Dunsink, Co. Dublin.*

During the year 1875 the Transit-circle has been in regular use. Considerable progress has been made in the exact determination of the places of the objects in Schjellerup's new *Catalogue of Red Stars*. A number of other stars have been observed for various reasons. A few minor planets have been included in the working list as occasion offered. Considerable progress has been made with the reductions, extensive tables for facilitating which have been constructed in great part by Dr. Brünnow.

Dr. Brünnow had completed an examination of the Transit-circle with the exception of circle B. The systematic errors of the divisions of circle A as determined by him do not, for four microscopes, in any case exceed  $0''\cdot 6$ , and even this quantity is almost entirely eliminated by the application of a correction of the formula,  $a \sin 2\omega$ . The periodic errors of the microscope-screws were originally rather large; but a re-examination by Dr. Copeland last autumn shows that, although still retaining the same general character, the coefficients have become much smaller. A new sidereal clock, by E. Dent & Co., with zinc-steel compensation, has been erected.

It is Dr. Ball's intention to resume the observations for Annual Parallax with the South Equatoreal. In fact, a commencement has been already made.

*Royal Observatory, Edinburgh.*

Professor Smyth reports that during the past year his time and that of his assistants, Mr. Wallace and Mr. Heath, have been employed on the following work:—

1. The daily exhibition of the correct time by means of electric time-ball, time-gun, and controlled clocks over Edinburgh and its neighbourhood.

2. The computations of the bi-diurnal observations made at 55 of the stations of the Scottish Meteorological Society, and their condensation for the Reports printed monthly and quarterly of the Registrar-General of Births, Deaths, &c., in Scotland.

3. Twelve months' hard work for all hands at the Star-catalogue computations from 1830 to 1870.

4. Reports, as called for, to H.M. Office of Works on the state and quality of the several portions of the New Equatoreal, which is still unpassed out of the hands of that department. The most important question therein was concerning the figure of the large silver-on-glass speculum, and in that the Astronomer, as he is most happy to mention, had the able assistance of the Rev. H. Cooper Key, of Hereford, who kindly came to Edinburgh at his own expense for that sole purpose.

5. Further particulars of the present state of the Observatory and its works are contained in a detailed Report by the Astronomer, presented last May to the Board of Visitors, Edinburgh, and since then printed and generally distributed. Professor Smyth remarks that the total expenditure of the Observatory during the past year, including salaries, instrumental repairs, and office expenses, amounted to £1,070.

### *Glasgow Observatory.*

The astronomical operations at the Glasgow Observatory during the past year have consisted mainly in the reduction to the commencement of 1870 of the zenith distances of small stars which have been accumulating at the establishment since the year 1860. The work is now considerably advanced; and it is intended soon to prosecute the observations with the Transit-circle more actively, with the view of procuring the materials which may be required for the final completion of a catalogue of stars. The usual operations for transmitting Greenwich time to the city and port of Glasgow have been conducted without interruption as in former years. A similar remark applies to the meteorological observations obtainable with self-registering instruments, which are prosecuted at the Observatory in connection with the Meteorological Committee of the Royal Society, and also to the ordinary meteorological work of the establishment.

### *Kew Observatory.*

The photoheliograph transferred to Greenwich in February 1873, having been returned by the Astronomer Royal, has been replaced in the dome of the Observatory.

The re-examination of the measurements of the Kew Sun-pictures, taken during the ten years 1862-1871, has been steadily carried on, the expense attendant on the same being borne by Mr. De La Rue. The discussion of the photograms obtained of the 15-ft. scale, erected for the purpose of determining the optical distortion, has been completed; and tables for determining the angle of position of the Sun's axis and the latitude and longitude of the Earth referred to the Sun's equator, for use in the reduction of the solar photograms, have been printed for, and distributed by Mr. De La Rue.

Experiments were carried on throughout the greater part of last year with the Photometer designed by Prof. H. Roscoe for

measuring the total intensity of daylight, and the registering Sun-dial invented by Mr. Campbell, which was in operation for several years at Whitehall, has been set in action on the roof of the Observatory, together with a modified form of the instrument, by which a daily record is obtained of the Sun's heating power.

Certain apparatus used for the swinging of invariable pendulums, which was in store at the Observatory, having been repaired at the expense of the Admiralty, two officers attached to the Arctic Expedition attended at Kew for some weeks, and after going through a course of instruction in the use of the apparatus and the method of observing pendulum vibrations, made a set of observations, which are recorded for the purpose of making Kew a base station. The apparatus was then dismounted, packed, and shipped on board the "Discovery."

The usual work of the Observatory in the Magnetical and Meteorological departments has been carried on throughout the year without intermission, and great activity has prevailed in the Verification of Instruments department.

#### *Liverpool Observatory, Bidston, Birkenhead.*

The work at this Observatory has for several years past been largely devoted to the testing of chronometers for weekly periods, in each of the three temperatures,  $55^{\circ}$ ,  $70^{\circ}$ , and  $85^{\circ}$ , and no change has been made during the past year with the exception of one occasion, on which a large number of chronometers were exposed for a special purpose during one week to a temperature of  $95^{\circ}$ .

On comparing results obtained some years ago with those of a more recent date, there is a marked improvement in the primary compensation for temperature correction as regards its adaptation to an ordinary sea voyage. A large proportion of the new chronometers tested at this Observatory during the past year have been found to have their maximum gaining rates in temperatures ranging between  $65^{\circ}$  and  $75^{\circ}$  of Fahrenheit, so that the correction due to imperfect thermal adjustment, between about  $60^{\circ}$  and  $80^{\circ}$ , has often been found to be very small; at  $40^{\circ}$  from the maximum gaining rate the average daily loss is, however, nearly five seconds. It would be a great boon to navigation if all chronometers were tested for the necessary data, and the rates calculated and supplied to the mariner for every degree of Fahrenheit from  $55^{\circ}$  to  $95^{\circ}$ . The expenses attendant on so giving the rates might be recouped by a charge of about £1 for each chronometer, and for this small sum the value of the instrument for finding the longitude at sea would be enhanced to an extent scarcely credible to the inexperienced in these matters.

*Temple Observatory, Rugby School.*

The past year has been chiefly occupied in the measurements of double stars with the Alvan Clark Refractor. The number of stars measured is 303, a somewhat smaller number than last year. The decrease is due, partly to the exceptionally small number of nights sufficiently fine to be utilised for this purpose, and partly to the fact that Mr. Wilson has been prevented by ill-health from taking part in the work. All the measures have been taken by Mr. Seabroke and Mr. Percy Smith.

The spectroscope carried on the 12-inch Reflector has been used for mapping the positions and forms of solar prominences, and for other observations of the Sun. The number and size of the prominences during this year having been very small compared with those of previous years, it was deemed expedient to substitute for the ring slit (which shows one-half of the chromosphere in the field of view at one time) a slit the jaws of which were turned to a segment of a circle, on which about  $20^{\circ}$  of the Sun's limb exactly fitted. This was used in the place of the ordinary slit, and of course a larger image of the chromosphere seen. Drawings were made on 35 days.

Early in the year an astronomical clock by Cooke was purchased from Mr. E. Crossley. It is placed in Mr. Wilson's house, and regulates, by an electric current, an ordinary eight-day clock in the Observatory.

A few drawings of *Jupiter* have been made by members of the School, who have also assisted to some extent in other work.

*Stonyhurst Observatory.*

The reduction of the magnetic records of past years has occupied most of the time that could be spared, during the last twelve months, from the ordinary routine work of the Observatory.

The absence of the Director on the Transit of *Venus* Expedition to Kerguelen Island has interfered somewhat with astronomical work; but the regular observation of *Jupiter's* satellites, of lunar occultations, and of the November meteors has not been interrupted.

*Mr. Barclay's Observatory, Leyton, Essex.*

During the past year attention has been given to the perfecting of the Leyton double-star catalogue. All known and suspected binary systems are kept in the working catalogue.

Sir J. Herschel, shortly before his death, was kind enough to

send Mr. Barclay a list of stars that he thought worthy of particular attention. Some of these have been observed and will form part of the next volume of *Observations*. The weather during the past twelve months has, here, been most unfavourable for delicate measures.

The instruments remain in the same condition as last year. Several gentlemen who are building observatories have visited Leyton for the purpose of inspecting the dome, the arrangements of which (described in Vol. I. *Leyton Observations*) continue to give perfect satisfaction.

#### *Colonel Cooper's Observatory, Markree.*

Dr. Doberck, who has charge of this Observatory, reports that the instruments have not been employed since the death of the late Mr. Cooper. On his appointment he found the instruments decaying from neglect, the steel pivots corroded with rust, the micrometers and clock-work covered with dust, and the building in such a dilapidated condition that the rain penetrated through the roof. The Refractor, exposed during forty years in the open air to the winds and rain of Connaught, was of course in the worst condition. It has now been restored as far as practicable. The old clock-work still drives it as well as could reasonably be expected. On account of the delay caused by the workmen, the repairs of the instruments were carried on so slowly that Dr. Doberck was only able to commence observations in December. He has measured several double stars with the Refractor, and also observed some planets with the Meridian-circle. A cheap Chronograph has been lately added to the instruments.

Since the latter part of 1874 the Observatory has been furnished with a complete set of meteorological instruments, and observations have been made daily at 9 A.M. and 9 P.M., according to the regulations of the Meteorological Office. These observations have been made by Miss A. Doberck. The requisite examination of the instruments before they could be made available for the observations has necessarily occupied a large portion of Dr. Doberck's time during the year.

#### *Mr. Edward Crossley's Observatory, Bermerside, Halifax.*

During the year 1875 the measurement of binary stars and the observation of the phenomena of Jupiter's satellites have been, as in previous years, the chief work of the Observatory. Owing to bad weather the number of observations has been unusually small; but much time has been spent in compiling a

list of measures of most of the double stars observed here since 1869. This list, which gives the magnitude, Right Ascension and Declination for 1880, position-angle, and distance of 484 stars, is already printed as part of the 42nd volume of the Society's *Memoirs*.

*Lord Lindsay's Observatory, Dun Echt.*

The work of the Observatory during the past year has been confined to the reduction of observations and the determinations of instrumental constants in connection with the Transit of *Venus*.

Considerable progress has been made in this long and tedious work, and until it is completed the force of the Observatory will be exclusively devoted to it.

*The Earl of Rosse's Observatory, Birr Castle, Parsonstown.*

During the past year the observations of nebulae and the micrometrical measurements of positions and distances between neighbouring nebulae and between nebulae and stars have been continued. Attention has been principally directed to those objects about which, on looking over the work of former years, some uncertainty or disagreement appeared to exist in the observations, and, partly from keeping this end in view, the number of objects observed was somewhat less than the average of former years, though the number of nights on which the telescope was used was fully as great.

Owing to delay on the part of the contractor, who is only just now erecting the 3-foot mounting, that instrument could not be employed in this work as had been intended.

The meteorological readings have been continued at 9<sup>h</sup> A.M., 12<sup>h</sup> 20<sup>m</sup> P.M., and 9<sup>h</sup> P.M. (Dublin time) as in the last quarter of 1874, and the results have been sent to the Meteorological Office.

*Colonel Tomline's Observatory, Orwell Park, Ipswich.*

Owing to the paucity of comets during the past year, the operations at this Observatory have been fewer and less important than had been hoped for. The equipment of the Observatory with a view to the observation of comets has been completed, though not in time to secure a satisfactory set of observations of Encke's Comet, which was first seen here on January 31. The cometary observations made in 1874, after being carefully reduced, have been published in the *Astronomische Nachrichten*.

Meridional observations of the Moon and culminators have been made, for the determination of longitude, upon every available occasion, both before and after the opposition of the Moon, and the instrument used being constructed upon the same model as those employed in the observation of the Transit of *Venus*, the accuracy of the result obtained may have a special interest at the present time. Some measures of the diameter of *Venus*, made a few years ago, having given rise to a strong suspicion that the factor of irradiation varies with the transparency of the atmosphere, a careful estimation of the brightness of the sky is made with each observation of the Moon; and it is anticipated that the separate results of longitude will show a marked relation to these estimations. In consequence of the prevalence of unusually cloudy weather for so many months, this work is still in progress.

A number of stars likely to show some irregularity of proper motion have recently been selected for observation. In the absence of cometary work, the re-observation of these stars is being pushed forward with vigour.

#### *Royal Observatory, Cape of Good Hope.*

In the year 1875 all the stars of Lacaille's Catalogue, and some others of about the seventh magnitude according to Lacaille's scale, in the zone  $145^{\circ}$  to  $155^{\circ}$  N.P.D., were observed with the Transit-circle. The number of stars contained in this zone exceeds 1,700, and each has been observed three times. A working catalogue for the zone  $135^{\circ}$  to  $145^{\circ}$  N.P.D. has been prepared, and observations will commence with the year 1876.

The observations of stars in the zone  $155^{\circ}$  to  $165^{\circ}$  N.P.D. made in the year 1874 afford positions of more than 1,000 of Lacaille's stars. The reductions are completed to mean places, examined, and the results read into ledgers. There remains only an examination of a few cases of discordant results before the completion of the catalogue and the printing of the work.

The observations made in the years 1871, 1872, and 1873 are printed, and only await the passing through the press of a short introduction before the results are ready for distribution. This volume of results contains positions of all Lacaille's stars within  $15^{\circ}$  of the South Pole.

The reductions at this Observatory had lately got ahead of the printing power available at the Cape, and the Astronomer availed himself of the opportunity afforded by a visit to England in the summer to print there the results for 1872 and 1873. The leisure afforded by this visit was also utilised to advance the examination and preparation of the Catalogue of Cape Observations, 1834 to 1840, and the services of Mr. Wright were secured for some time upon the same work. Since the Astronomer's

return, all his available time has been devoted to a systematic examination of this work, and about 8 hours are prepared for press, and the preparation of the remainder is far advanced.

The want of systematic examination in some of the earlier stages, and the number of single observations of stars, has rendered the work of final examination much heavier than had been anticipated. The catalogue will contain positions of more than 2,000 stars; but, from the use of two instruments, the Transit and the Mural-circle, unavoidable at the time, a large number of the observations are not complete in both elements.

A Photo-heliograph has been secured for the Observatory, and has quite recently reached the Cape. The arrangements for the erection of the necessary buildings are in progress, but the chemicals and chemical apparatus have not yet been received. It is hoped that, without interfering with the regular work of the Observatory, two photographs of the Sun may be obtained every clear day. These, with the photographs secured in England, should be sufficient to afford a daily record of the Sun's disk. Should, however, the work be taken up systematically at other southern stations, then, to avoid unnecessary duplication of the work, the Cape instrument would only be employed occasionally to trace changes in groups of spots, or upon other special inquiries.

The large Spectroscope ordered for this Observatory some years ago, and which was completed just as the Astronomer left England, has not, from some unaccountable delay, yet reached the Cape.

The zeal displayed by the assistants in clearing off the large zone of stars  $145^{\circ}$  to  $155^{\circ}$  N.P.D. during the year needs a word of warm commendation.

#### *Adelaide Observatory.*

Mr. Todd mentions in his Report to the Government of South Australia, dated September 24, 1875, that the astronomical work of the Observatory during the preceding year has been confined principally to the meridional observations of transits of clock-stars for the determination of local mean time, and to occasional extra-meridional observations made with the 8-inch Equatoreal by Cooke mounted in December 1874. Owing to the extremely moderate instrumental equipment of the Observatory, which, until the mounting of the new Equatoreal, consisted only of a small Transit instrument lent by the Victorian Government and an old Altazimuth, astronomical observations have necessarily been very limited. Mr. Todd, however, is very desirous to make the Observatory in future practically useful to the Colony as an educational establishment in connection with the University and higher-class schools. In making

this proposal to the authorities, he has no wish to curtail the usual regular work; but he thinks that it might also be easily extended, and thus render valuable aid in those branches of astronomical research which do not involve continuous observation or heavy computation, especially of solar and stellar spectroscopy, Sun-spots, double stars, and observations of the phenomena of *Jupiter's* satellites.

During the late Transit of *Venus* a large number of micrometric measurements were made; and also a series of differential observations in R.A. and N.P.D. were made of *Mars* during the recent opposition. The time-ball has been dropped by a galvanic current from the Observatory at 1 P.M. daily, except on Sundays, since the beginning of August. This daily exhibition of mean time at Adelaide is regarded as a great boon by those connected with the shipping; and its usefulness is much increased by the time-ball being visible from the port, and outside at the anchorage in the gulf.

An excellent six-prism Universal Automatic Spectroscope, by Browning, adapted for telescope or table work, and a large induction coil, by Siemens, have been provided. Mr. Todd is anxious now to procure a Transit-circle with an object-glass of 5-in. aperture, and a 3-ft. or 3-ft. 6-in. circle, so that meridional observations may be made in both elements. The transit-clock is not a good one, and it is proposed to substitute a new clock for it, now that the responsibility of dropping the time-ball devolves upon the Observatory. The new 8-inch Equatoreal is favourably reported upon, the definition being good, the Moon, *Jupiter*, and *Saturn* often bearing the highest power, 660. Mr. Todd, however, remarks that there is more blue light than he likes, which is especially noticeable in the case of *Mars*.

The meteorological branch of the Observatory continues its regular work, the observations of the usual elements being made five times each day. Similar but less complete observations are made at several of the telegraph offices, and at most of the lighthouses, and forwarded periodically to the Observatory. Rain-gauges have been supplied to about seventy stations in the Colony, which send in their records monthly.

### *Melbourne Observatory.*

Referring to the Report of Mr. White, the acting Government Astronomer during the absence of Mr. Ellery in Europe, presented to the Board of Visitors in June last, we gather that the preceding year had been one of great activity in all branches of astronomy. Mr. White writes:—"Not only had we to make the necessary preparations for observing the Transit of *Venus* at our own stations, but we had also to assist with the requisite observations for finding the positions of the station"

occupied by the different nations in this part of the world. For this purpose the transits of the Moon and culminating stars were observed at every opportunity during the four months commencing with October 1; during the same period also every available occultation of a star by the Moon was observed. Besides this, the stars used by Professor Peters, who had charge of the American party at Queenstown, in New Zealand, in determining the latitude of his position, have been so far as possible observed, also the comparison-stars used by ourselves and by Mr. Tebbutt, of New South Wales, in finding the place of the fine comet of Coggia, which first appeared here in July 1874. Observations were also taken for finding the difference of longitude between our Observatory and Lieut. Harkness's station at Hobart Town."

The usual observations of stars have been made with the Transit-circle, including those for the determination of clock and instrumental errors, close circumpolar stars, low stars for refraction, comparison-stars observed with the Equatoreal, Moon-culminating stars, and those which have been observed by request for some special purpose. The total number of R.A. observations during the year was 2,064, and of P.D. observations 1,150. The principal work done with the great telescope has consisted of drawings of nebulæ and mapping the neighbouring stars. Ten nebulæ delineated by Sir John Herschel have been carefully drawn, and the stars laid down from micro-metrical measurements. A drawing of the nebula surrounding  $\eta$  *Argus*, with the stars accurately inserted, shows no appreciable difference from one made in the preceding year.

Special mention is made in the Report of the new and important instruments which have been added to the establishment. These include the Photo-heliograph used for the Transit of *Venus*, an Equatoreal Refractor of eight inches aperture by Troughton and Simms, a portable Equatoreal of  $4\frac{1}{2}$  inches aperture by Cooke, and a double-image Micrometer by Browning. Two barrel Chronographs have also been received, governed by a conical pendulum, mounted according to Huyghen's suggestion, so that the centre of oscillation describes a parabola in moving towards or from the central axis. The advantages of this mechanical contrivance for the registration of transits were fully explained by Mr. Ellery in a paper read by him before the Royal Astronomical Society at the ordinary meeting in December last.